# Achievements in the genetic improvement of forest trees in Australia and New Zealand: a series of papers presented in this and following issues of the journal

*Australian Forestry* has commissioned a series of papers designed to present to the profession at large an account of achievements in the genetic improvement of plantation species, and directions for continuing progress. Because of the close links between Australia and New Zealand and the notable contributions New Zealand has made to plantation research and development, the series incorporates reports of advances from both countries.

Australia's native hardwood (eucalypt) forests supplied the bulk of Australia's wood requirements from European settlement of the country until late in the 20th century; this production was supplemented by mainly softwood imports. The limitations of the eucalypt forests and particularly those of the native softwood resource were recognised late in the 19th century, and this lead to the initiation of softwood planting. With the exception of hoop pine in the subtropics, these plantations have been based on exotic species, predominately radiata pine in temperate regions and the slash/Caribbean pine complex in the subtropics.

Four phases can be recognised in the Australian plantation program: (i) early 'softwood import replacement' to the mid-1950s; (ii) increased planting extending to the mid-1970s in order to achieve national 'self-sufficiency' in wood production (based in part on Commonwealth funding of expanded plantation programs); (iii) increasing private investment in softwood plantations through the 1980s and limited expansion of the then small area of eucalypt plantations; and (iv) beginning in the 1990s, a shift to private investment as the dominant source of funds for plantation establishment and a strong emphasis on planting eucalypts. Australian plantation forests now occupy about 1.75 million ha, two-thirds of which is softwood.

In contrast to Australia, New Zealand plantations have relied entirely on exotic species. These were planted on farms from about 1860 for shelter, firewood and general amenity. Pilot-scale planting for sawn timber began before 1900, and from around 1900 the state engaged in commercial afforestation, often under the Justice Department to employ prisoners. Later the state plantations became state forests, managed by the Forest Service. The first foresters favoured species such as Corsican pine, Austrian pine, European larch and Norway spruce from Europe, although Douglas-fir, ponderosa pine and lodgepole pine from North America, and some eucalypts, were also tried. Because of its superior growth, however, radiata pine gradually became the preferred species. Eucalypts and other coniferous genera, like cypresses, figured little until the 1970s when the NZ Forest Service adopted a policy of developing small working circles of special-purpose species. From 1970 onwards, one or two companies established substantial eucalypt plantations for short-fibred pulp.

The development of plantations in NZ can be regarded as occurring in five phases: (i) a species-introduction and farm-woodlot phase up to 1900; (ii) state forest plantation development up till World War I; (iii) a major planting boom during 1925–1935; (iv) planting concentrating on radiata and the development of silviculture from 1950 onwards; and (v) the post-1990 era of state forest sales and multiple ownership by many different companies, but with smaller enterprises doing most of the new planting. New Zealand plantations now total about 1.8 million ha.

The Australian and New Zealand plantation programs have generated a substantial body of research and development leading to knowledge, technology and practices for improving the yield of wood, and the quality of tree boles and wood properties for specific end uses. With scientifically based management, overall production is improving across a range of soil and environmental conditions and forest ownerships.

Programs for the genetic improvement of forest trees are one of the key tools for enhancing plantation profitability and sustainability. They incorporate assessment of genetic diversity in species; and selection and breeding to improve a range of growth, adaptation and wood quality traits. They commonly include inter-specific and or intra-specific hybridisation, evaluation of genetic gains under specific soil and environmental conditions, and development of large-scale propagation technology including clonal forestry backed by strategies to minimise risk.

The series will describe tree improvement programs for the more-widely-planted softwood species: radiata pine (with separate papers covering achievements in Australia and New Zealand), hoop pine and the slash/Caribbean pine complex. Other softwoods to be examined include maritime pine in Western Australia, and Douglas-fir and cypress in New Zealand. Achievements in hardwood tree improvement relate to plantations in both the temperate region (southern blue gum, shining gum, eucalypts in New Zealand), and the subtropical region (blackbutt, Dunn's white gum and Corymbia species and hybrids). No account of Australian tree improvement would be complete without describing more recent work on species for dry regions, species for saline conditions, and oil-producing species. An overview of forest tree improvement will be presented at the end of the series.

The series commences in this issue with contributions on programs for blackbutt, Dunn's white gum, Corymbia species and New Zealand Douglas-fir, and species for low-rainfall environments.

***The Editor***